

SPD Employee Continuing Education

Training Guides



Medical Gas

Prepared by the SPD Advisory Group
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MEDICAL GAS

OBJECTIVES

Upon completion of this session, participants will be able to:

1. Identify various medical gases
2. Handle medical gases safely
3. Transport medical gases safely
4. Understand the pin safety system
5. Storage of medical gases
6. Medical gas hazards

Equipment needed for training:

- O₂ and Nitrogen (“E” and “H”) tank with carrier
- O₂, Nitrogen, and Nitrous Oxide regulator (“E” & “H”) with wrench
- Material Safety Data Sheet (MSDS)

INTRODUCTION

Compressed gases are used in many industrial and laboratory operations for a variety of different operations. However, compressed gases present a unique hazard. Depending on the particular gas, you can be at risk for both mechanical and chemical hazards. Gases may be:

- Flammable or combustible
- Explosive
- Corrosive
- Poisonous
- Inert
- Or a combination of hazards

Gas vapors spread rapidly. If the gas is flammable, you must be concerned about its flash point. The flash point is the lowest temperature at which gas vapor will ignite in air when exposed to a flame or spark. The flash point can be lower than room temperature. Because of the way fumes spread and the possibility of low flash points, gases present a danger of fire or explosion. Gases can also be poisonous. They can react with other things they are exposed to. Asphyxiation can be caused by high concentrations of even “harmless” gases such as nitrogen. Since the gases are contained in heavy, highly pressurized metal containers, the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb. You must be very careful when you handle compressed gases, the cylinders containing the compressed gases, regulators or valves used to control gas flow, and the piping used to confine gases during flow.

Identification

The contents of any compressed gas cylinder must be clearly identified.

The identification of a compressed gas cylinder must include a label. You should not accept any compressed gas cylinder for use that does not legibly identify its contents by name. If the labeling on a cylinder becomes unclear to the point that you cannot identify the contents, the cylinder should be marked “contents unknown” and returned directly to the manufacturer.

Medical gases should not be identified by the color of the tank. Cylinders are often subject to rough handling that can wear, chip and discolor paint making identification of the original color difficult. Room lighting may also contribute to misidentifying the colors.

Never rely on the color of the cylinder for identification.

Color-coding is not reliable because cylinder colors may vary with the supplier. Additionally, labels on caps have little value because caps are interchangeable.

The following example was taken from the VA National Center for Patient Safety, Volume 1, Issue 2. Room lighting, chipping of paint, modified regulator, and wear and tear on the tank color contributed to the following incident.

CO₂ is routinely used during the provision of patient care in a number of clinical settings such as radiology, anesthesiology, and laparoscopy. Because of a lack of knowledge regarding specialized regulators designed to deliver CO₂, and O₂ regulator fitted with a universal adapter to override the safety pin index was placed on a CO₂ tank. The standard color for CO₂ tanks is gunmetal gray; however, in some cases O₂ tanks are old green tanks that have been painted battleship gray. These gray-green “E” cylinder-sized tanks had been lined up next to oxygen “E” cylinders. Following a medical procedure, a patient using O₂ was transported for follow-up imaging. This patient needed O₂. On this day a CO₂ tank was inadvertently picked up and used during the patient transport instead of O₂ creating a hazardous situation.

Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or the trade name of the gas. Such marking shall be by means of stenciling, stamping, or labeling, and shall not be readily removable. Whenever practical, the marking shall be located on the shoulder of the cylinder. This method conforms to the American National Standard Method for Marking Portable Compressed Gas Containers to Identify the Material Contained, ANSI Z48.1-1954, which is incorporated by reference as specified in Sec. 1910.6.

Handling and Use

Gas cylinders must be secured at all times to prevent tipping.

Cylinders may be attached to a bench top or individually to the wall. They may be placed in a holding cage, or have a non-tip base attached. Chains or sturdy straps may be used to secure them.

The Compressed Gas Association (CGA), to prevent mixing of incompatible gases, has devised standard cylinder-valve outlet connections. The outlet threads used vary in diameter; some are internal, some are external; some are right-handed, some are left-handed. In general, right-handed threads are used for non-fuel and water-pumped gases, while left-handed threads are used for fuel and oil-pumped gases. The threads on cylinder valves, regulators and other fittings should be examined to ensure they correspond and are undamaged.

The cylinder valve should be accessible at all times. The main cylinder valve should be closed as soon as it is no longer necessary that it be open (in other words, it should never be left open when the equipment is unattended or not operating). This is necessary not only for safety when the cylinder is under pressure, but also to prevent the corrosion and contamination resulting from air and moisture getting into the cylinder when it is empty.

When opening the valve on a cylinder containing an irritating or toxic gas, position the cylinder with the valve pointing away from you and warn others who are near.

Whether full or empty, oxygen cylinders should not be stored in the same vicinity as flammable gases. You must maintain a minimum of 50 feet between flammable gas cylinders and oxygen cylinders or the storage areas must be separated, at a minimum, by a firewall five feet high with a fire rating of 0.5 hours. Greasy and oily materials must never be stored around oxygen, nor should oil or grease be applied to fittings.

Inside buildings, cylinders should be stored in a well-protected, well-ventilated, dry location, at least 20 (6.1m) feet from highly combustible materials such as oil or grease. Cylinders should be stored in regularly assigned places away from elevators, stairs, or gangways. Assigned storage spaces should be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons. Cylinders should not be kept in unventilated enclosures such as lockers and cupboards. Empty cylinders must have their valves closed.

Valve protection caps, where the cylinder is designed to accept a cap, the cap should always be in place, hand-tight, except when cylinders are in use or connected for use. Oxygen cylinders should not be stored near highly combustible material, especially oil and grease; or near reserve stocks of carbide and acetylene or other fuel-gas cylinders or near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.

Regulators

Regulators are gas specific and not interchangeable!

Medical gas regulators have a built-in safety system. This safety feature is known as a “pin index system.” The pins on the yolk of a regulator are configured in a manner that will only mate to the configuration of the proper gas cylinder

Always make sure that the regulator and valve fittings are compatible. Before connecting a regulator to a cylinder valve, open the valve slightly and then close it. Before a regulator is removed from a cylinder valve, close the cylinder and release the gas from the regulator. Gauges on regulators should be marked “USE NO OIL.”

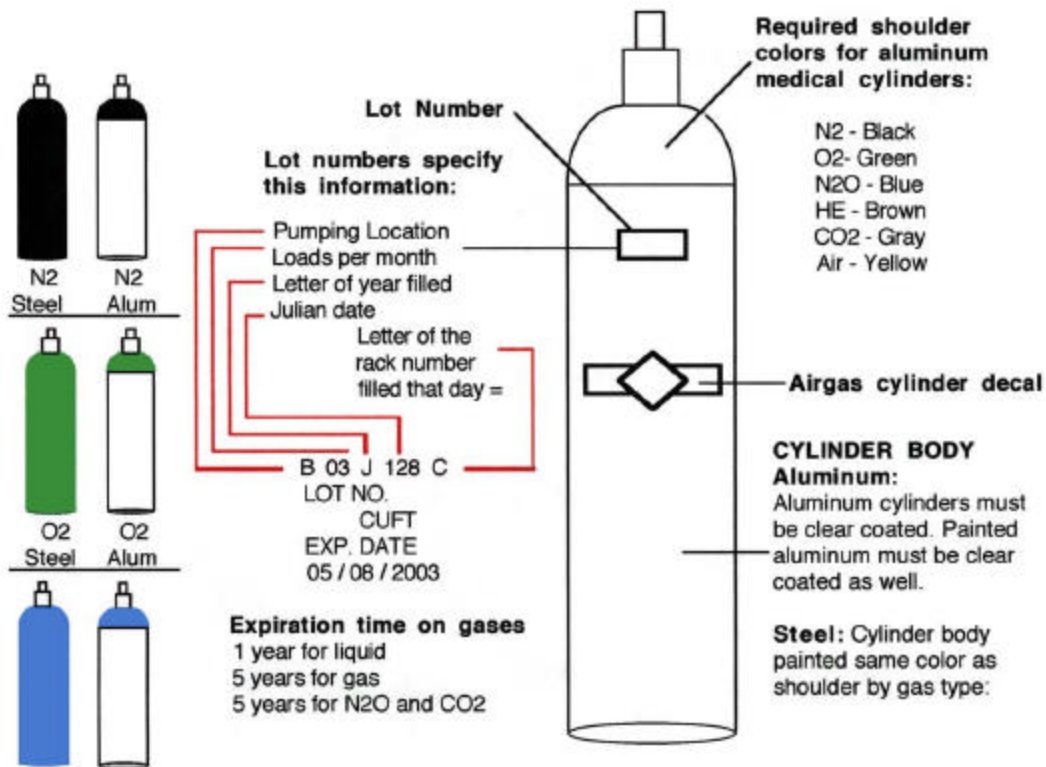
Transportation of Cylinders

Cylinders that contain compressed gases are primarily shipping containers and should not be subjected to rough handling or abuse. Such misuse can seriously weaken the cylinder and render it unfit for further use or transform it into a rocket having sufficient thrust to drive it through masonry walls.

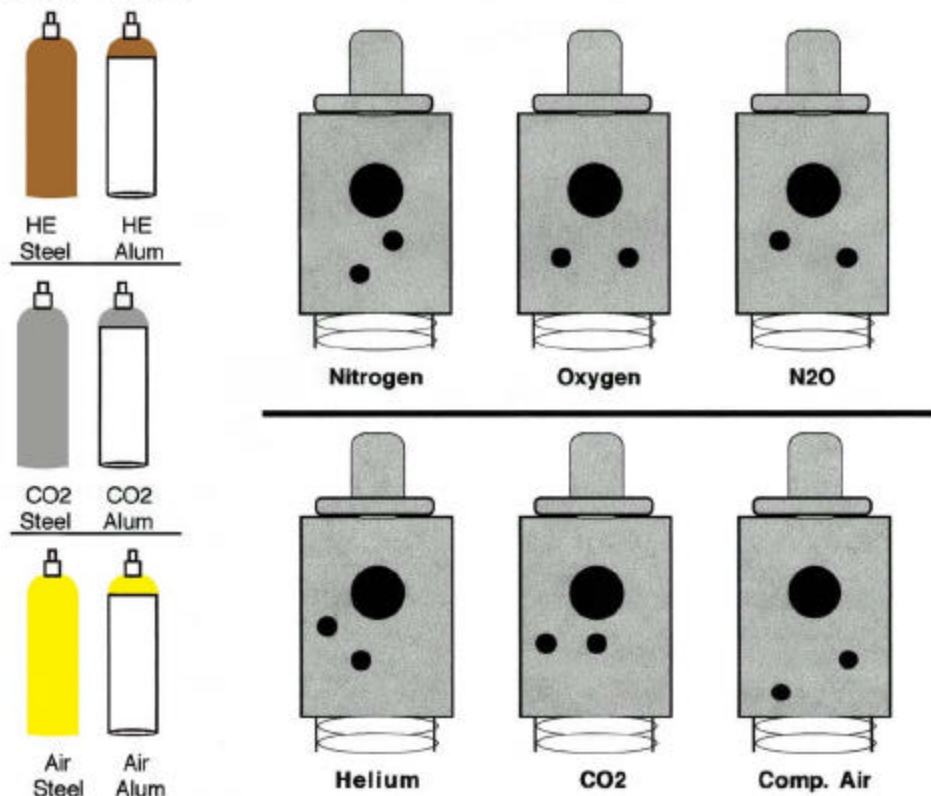
SAFE HANDLING TECHNIQUES:

- To protect the valve during transportation, the cover cap should be screwed on hand-tight and remain on until the cylinder is in place and ready for use.
- Cylinders should never be rolled, dragged, thrown, or dropped.
- Cylinders must not be left lying on the floor or free standing.
- When moving cylinders, they should be strapped to a properly designed wheeled cart to ensure stability.
- Only one cylinder should be handled (moved) at a time.

Airgas N.C.N. Medical Cylinder Color Chart and Valve Pin Chart for ANE Cylinders



Post valve cylinder pin indexing for ANE medical cylinders



- Reference:*
1. *OSHA REGULATIONS (STANDARDS – 29 CFR)*
 2. *VA NATIONAL CENTER FOR PATIENT SAFETY*
 3. *OKLAHOMA STATE UNIVERSITY*

QUIZ – MEDICAL GAS

1. An oxygen gauge can also be used on a:
☐ Nitrogen tank
☐ Nitrous Oxide
☐ Carbon Dioxide
☐ None of the above
2. Cylinders may safely be secured by:
☐ Duct tape
☐ Bracing the cylinder on two sides by non-movable objects such as two supply carts
☐ Chains
☐ All of the above
3. When equipment is left unattended or not operating, cylinder valves should always be:
☐ Closed
☒ Left open
4. When choosing the correct medical gas, you should adhere to the color code system.
☐ True
☐ False
5. The regulator pin index system was developed for the following regulators:
☐ Oxygen
☐ Carbon Dioxide
☒ Nitrous Oxide
☐ All of the above
6. Cylinders should never be rolled or dragged.
☐ True
☐ False
7. Cylinders containing flammable gases shall not be stored near:
☐ Areas where electrical sparks may be generated
☐ Bunsen burners
☐ Oxygen cylinders
☐ All of the above
8. If the oxygen gauge needle sticks, screw off the face cap and oil the needle with 4 and 1 household oil.
☐ True
☐ False
9. MSDS stands for Material Safety Data Sheet.
☐ True
☐ False
10. What does CGA stand for?

ANSWERS – MEDICAL GAS

1. None of the above.
2. Chains
3. Closed
4. False
5. All of the above
6. True
7. All of the above
8. False
9. True
10. Compressed Gas Association